

SB761
U7R6
#81-3

FOREST PEST MANAGEMENT

3430 BIOLOGICAL EVALUATION
R2-81-3

MOUNTAIN PINE BEETLE OUTBREAK

Holy Cross Ranger District

White River National Forest

1981



United States
Department of
Agriculture

Forest Service

Forest Pest Management
Denver, Colorado

3430 BIOLOGICAL EVALUATION
R2-81-3

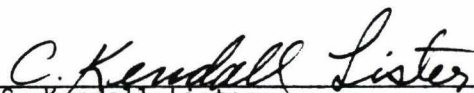
MOUNTAIN PINE BEETLE OUTBREAK

Holy Cross Ranger District

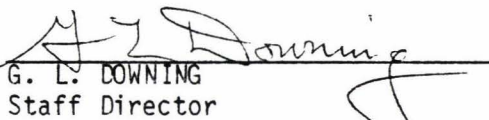
White River National Forest

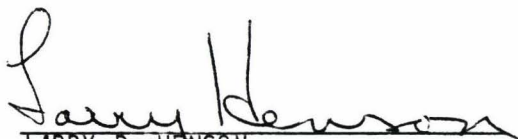
1981

PREPARED BY:


C. Kendall Lister
Supervisory Entomologist

APPROVED BY:


G. L. DOWNING
Staff Director
Forest Pest Management


LARRY D. HENSON
Deputy Regional Forester
State and Private Forestry

Forest Pest Management
State and Private Forestry
Rocky Mountain Region
USDA Forest Service
11177 W. 8th Avenue
Lakewood, Colorado 80225

INTRODUCTION

An outbreak of mountain pine beetle (*Dendroctonus ponderosae* Hopkins) has become epidemic in lodgepole pine (*Pinus contorta* var. *latifolia* Engelman) on the Holy Cross Ranger District of the White River National Forest. A special management area has been established by District personnel (Figures 1 and 2). This special management area includes the communities of Minturn, Vail and Beaver Creek and an associated buffer zone. Other special designated areas within are Elk Enclave and a portion of the recently established Holy Cross Wilderness.

It is in this special management area that a biological evaluation was conducted. Elsewhere on the Ranger District, mountain pine beetle (MPB) is active in the drainages of Homestake, Rock Creek, Pine Creek, Muddy Creek and Piney River. Additional biological evaluations will be conducted in these areas as deemed necessary and requested by District personnel.

Field data to supplement existing Stage II data in this special project area were gathered by Jim Allen, Jim Linnane and Ken Lister during the week of December 1-5, 1980.

OBJECTIVES

The objectives of this biological evaluation were to:

1. Determine the population trend of the mountain pine beetle.
2. Obtain host information to estimate risk to mountain pine beetle attack.
3. Broadly estimate acreage of highly susceptible host type.
4. Provide a list of alternatives for managers to consider.
5. Present a suggested course of action.

BACKGROUND

The life cycle of mountain pine beetle is one generation per year, with the attack period occurring mostly from July 15 to September 1. For additional biological information, see Forest Insect & Disease Leaflet 2, USDA Forest Service, July 1979 (McCambridge, et al 1979).

Evidence of previous outbreaks are fairly common in lodgepole pine forests in Colorado. In 1910-1912 and 1944-1945, MPB infestations were recorded for the Minturn-Redcliff vicinity. To date the current outbreak, first noticed in 1976, has been rather localized, with the most noticeable infestation occurring in lower Cross Creek. Many of the lodgepole stands along the fringe in lower Cross Creek have been decimated and beetles are no longer

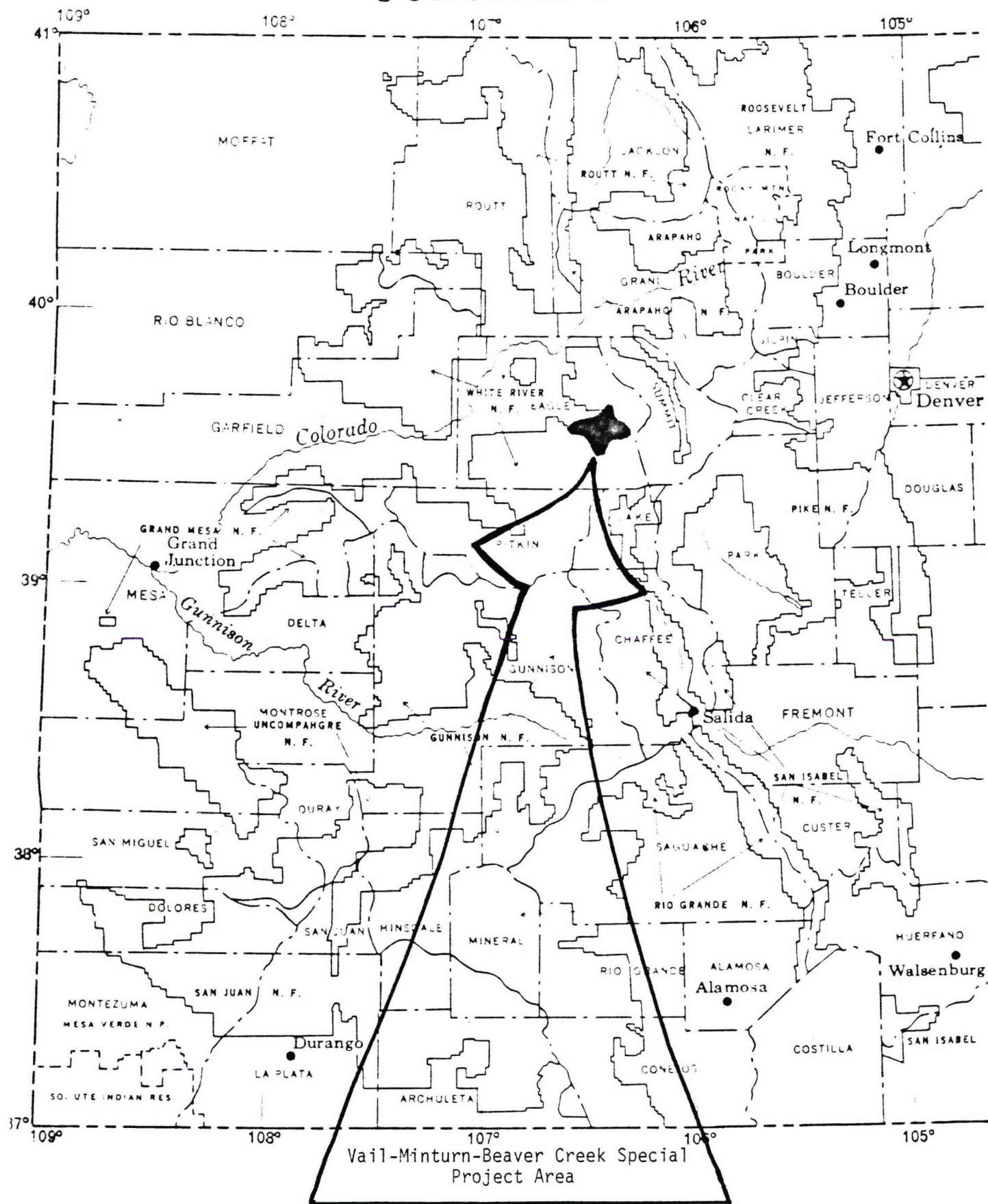


Figure 1. Reference Map for Biological Evaluation Area.

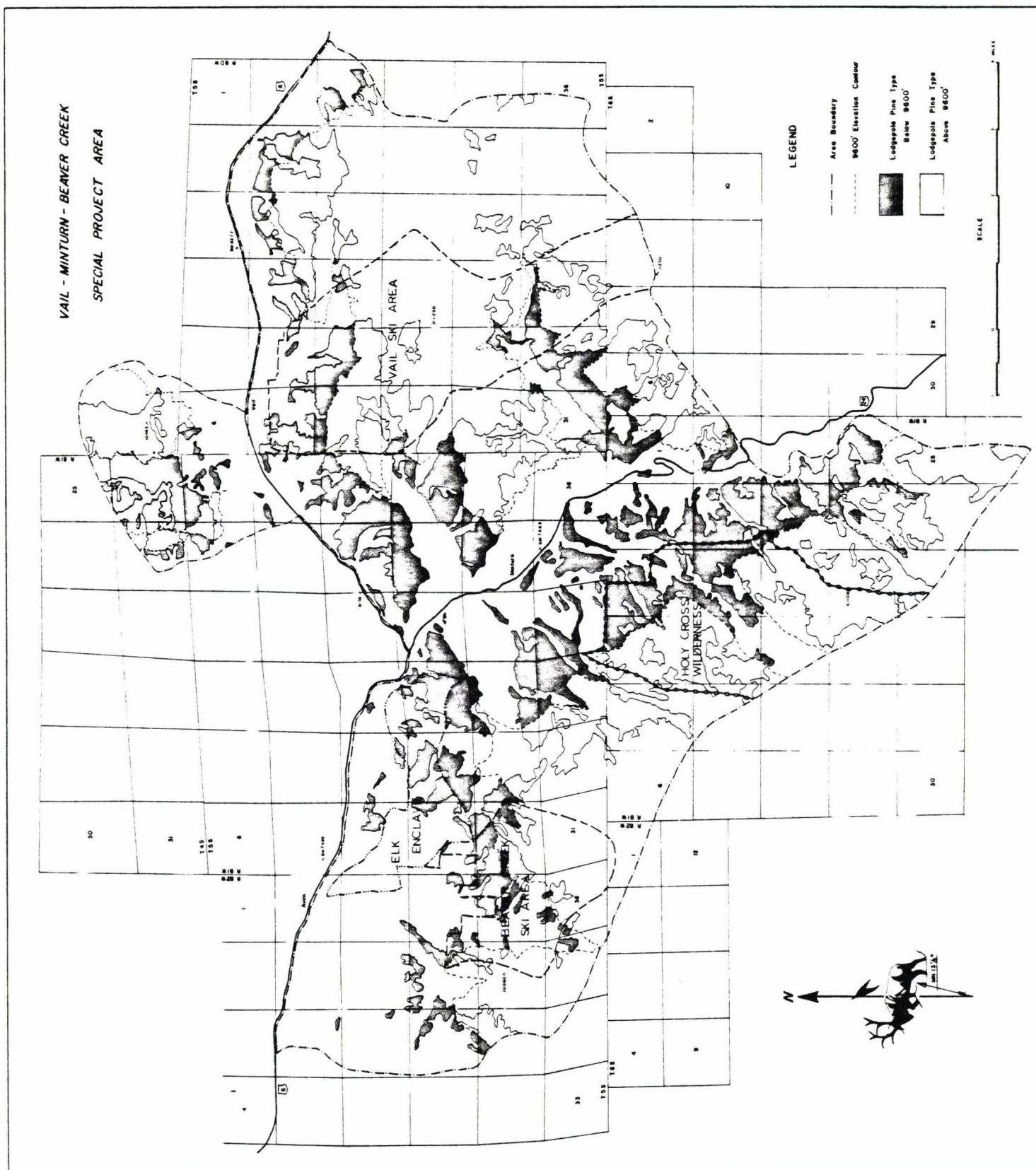


Figure 2. Reference map of Vail, Minturn, and Beaver Creek - Special Project Area showing subunits and lodgepole pine type.

active in these stands. However, new infestation spots have developed recently in Martin Creek, Grouse Creek, and Red Sandstone Creek.

It is natural for MPB populations to increase periodically and kill most of the large diameter trees in a stand before subsiding. The frequency of epidemics appears to be site related, with stands on better sites becoming higher risk more rapidly than those on poor sites. Frequency of epidemics appear to range from 20 to 40 years.

Mountain pine beetle epidemics develop in stands where the following characteristics coexist: (1) average stand diameter is 8 inches or greater, (2) average stand age is 80 years or more, and (3) climatic suitability as associated with elevation and latitude relationships.

METHODOLOGY

A. Mountain Pine Beetle Brood Sampling

The MPB population level was measured by removing paired bark samples 6 inches by 6 inches from opposite sides of infested trees. Counts of MPB brood were made and recorded for each bark sample removed. Data was summarized and used to predict the trend of the infestation utilizing "Sequential Table for Sampling Mountain Pine Beetle Fall Broods from a 6 x 6 inch Sample" (Cole 1965).

B. Mountain Pine Beetle Host Assessment

1. Host Data

- a. Existing Stage II information of lodgepole pine stands were provided by District personnel for the Beaver Creek Ski area and a portion of the Vail Ski area. Data were available from 6 compartments and 35 stands of pure or mixed lodgepole for a total of 1,817 acres.
- b. In the remainder of the lodgepole pine type five line transects were layed out and sampling conducted. Variable plots (10 BAF) were established at 10 chain (660 feet) intervals along the line transects. Data recorded at each plot were tree species, by 1 inch diameter classes, with lodgepole pine being recorded appropriately as green, current (infested with MPB), old (fader or a tree MPB had recently abandoned) and previous (trees killed by MPB last 2-10 years). On a non-systematic sub-sample basis, tree age was estimated from 14 dominant or codominant lodgepole pine. All lines were plotted on a topographic map to establish elevation.
- c. Lodgepole pine distribution for the special project area was obtained from National Forest type maps and recent aerial resource photography for the non-national forest lands.

Acreage of lodgepole pine type was then calculated for the project area, subunits and elevational zones.

2. Host Susceptibility

Utilizing the host data collected in the field and available Stage II data, highly susceptible areas were identified utilizing procedures outlined by Amman, G.D., et al (1977).

RESULTS

A total of 24 trees (48, 6 x 6-inch samples) were sampled. Samples contained a total brood count of 2,440 or an equivalent of 50.44 beetles per 6 x 6-inch sample. This number exceeds the upper limit of 50 required to predict an increasing epidemic.

Table 1. Summary of Mountain Pine Beetle Brood Sampling
(Pairs of 6 x 6-inch Bark Samples Per Tree)

	<u>Brood Counts</u>	<u>No. of Gallery Starts</u>	<u>Inches of Egg Gallery</u>
Totals	2,440	103	1,552
Range	0 to 129	0 to 6	3" to 52"
Mean	50.44 $\pm$ 27.72	2.15 $\pm$ 1.07	32.33 $\pm$ 12.78

The Vail-Minturn-Beaver Creek Special Project Area contains 59,000 acres. Lodgepole pine as commonly typed occurs on approximately 20,000 acres. Subunits already recognized within the special project area are Vail Mountain, Beaver Creek, Elk Enclave and a portion of Holy Cross Wilderness. A breakdown by acres for these is displayed in Table 2. A map showing the subunits and the distribution of lodgepole type for this special project area is shown in Figure 2.

Table 2. Summary by Units or Areas in the Vail-Minturn-Beaver Creek Special Project Area

Unit or Area	Lodgepole Pine Type (Acres)	Other Forest Types & Non-Forested (Acres)	Total (Acres)
Vail Mountain	2,447*	4,603*	7,050*
Beaver Creek	658*	2,142*	2,800*
Elk Enclave	440	1,290	1,730
Holy Cross Wilderness	3,055	1,295	4,350
Other	13,440	29,630	43,070
Unit or Area Totals	20,040	38,960	59,000

* These figures include some acres now cleared for ski trails.

Results of the line transect survey for the 18,223 acre area surveyed show there is an average of 221.8 green lodgepole pine trees per acre (>5" d.b.h.). The average diameter (d.b.h.) is 10.3" (See Appendix A for the "Survey Summary" printouts) and the average age is 130 years (range 96 to 150). Fifty-eight percent of the lodgepole stems and 80 percent of the basal area (square feet/acre) are in the high risk category to MPB infestation based on diameter (>8" d.b.h.).

Stage II data from 35 stands containing lodgepole pine overstory represents 1,817 acres. The average stand age is 74 years (range 17 to 140).

DISCUSSION AND CONCLUSIONS

The mountain pine beetle infestation is expected to continue spreading and cause additional tree losses. At the time of sampling the beetle population was high enough to sustain the outbreak in epidemic status. Also, the winter of 1981 has been unusually warm which should favor brood survival and subsequently produce a higher beetle population in the summer of 1981. The average age and diameter of the trees is sufficient to sustain continuation of the outbreak.

Utilizing lodgepole pine type map with the elevational parameter of <9,600 feet elevation, there are 10,120 acres which would be classified as being high risk to MPB infestation (see Figure 2 for a pictorial overview). The display in Figure 2 is overestimated somewhat in that the parameters of average diameter and average age have not been incorporated. Where risk rating was made of the Stage II data for the 35 stands only 2 stands were high risk; whereas using only the base of elevation-latitude, 14 out of 35 would have been classified as high risk (see Appendix B).

Refinement of the high risk category acreage is needed as the survey design for this evaluation was intended to provide only an overview. To properly risk rate lodgepole pine based on the present "state-of-the-art", data should be gathered for each timber stand, primarily in the LP8 and LP9 stand size class. In this survey, our 5 line transects crossed over or contained data from stand size classes 6 through 9. An example of risk rating utilizing the existing Stage II and general survey information is presented in Appendix B.

Heavy reliance on the direct control of mountain pine beetle outbreaks is highly questionable. Where sizeable acreage of susceptible lodgepole pine exists, direct control is, at best, only a holding action until the susceptibility is lowered (Cole and Amman, 1980). Despite any immediate success of direct control, the residual stand structure will be virtually the same after a given MPB outbreak unless concurrent stand management is conducted. After a large outbreak on the Teton and Targhee National Forests, comparisons of stand structures were made in areas of chemical (direct) control to similar untreated areas and were found to be

essentially the same (Amman and Baber 1972). Surviving lodgepole stand structure after the infestation ranged between 62 and 90 percent of the trees four inches d.b.h. or greater and 32 and 92 percent of the merchantable basal area.

To prevent mountain pine beetle epidemics in pure, even-aged lodgepole pine stands, stocking control is probably the most important consideration (Cole and Amman 1980). Diameter and age class can be regulated to reduce stand susceptibility to mountain pine beetle epidemics. The net response of stocking control for controlling or preventing MPB outbreaks is not yet known; however, a variety of silvicultural practices have been utilized and results are encouraging compared to the alternative of repeated thinnings by the beetles or disappointment associated with direct control. However, the manager must accept the risk of a MPB outbreak that could destroy most of the merchantable stand (Alexander 1975).

The mountain pine beetle infestation is expected to benefit big game if it becomes severe. Elk use, especially, appears inversely related to basal area, i.e., since more herbage is produced where tree density is lower (Clary and Larson 1971). Partial cutting and patch clearcutting might also favor elk use over current overstocked conditions. Deer use declines after clearcutting, but is followed by benefits that persist for over 20 years (Regelin and Wallmo 1978).

ALTERNATIVES

1. Protective Treatment. Apply a preventative spray (carbaryl formulation) on high value, high risk trees to protect them from attack by mountain pine beetle. The protective approach is especially compatible and practical for trees in campgrounds, and ornamental or decorative trees around homes and administrative sites.
2. Direct Control. Any technique that kills beetles in infested trees can be considered basically as direct control. In the past, chemical treatment, fell and burn techniques and logging of infested trees have been used to suppress infestations. These approaches only succeed in slowing outbreaks or spreading eventual tree loss over more time, not stopping them. As long as stands remain susceptible to the beetle, the infestations will continue.

Salvage logging of infested trees is of greater benefit since the trees are utilized, not lost. Additionally, infested trees can usually be sold instead of investing money to have them removed. Nevertheless, the basic conditions which favor the outbreak are not changed.

3. Clearcutting. The practice of clearcutting affords excellent control of mountain pine beetle within the cuts. It breaks up continuous lodgepole pine stands into single blocks or patches. Block clearcutting schedules and design should be compatible with the objectives of multiple-use management and regeneration needs.

4. Partial Cutting. Partial cuts to reduce mountain pine beetle infestations have been used operationally in Middle Park, Colorado and Green Ridge near Sandstone, Wyoming. Modified shelterwood, over-wood removal and group selection are sound silvicultural forms of partial cutting. Windthrow, dwarf mistletoe and comandra rust are important factors to be considered with partial cutting. Of course, one must never ignore regeneration needs.
5. Do Nothing. When suppression is not justified because of economics, environmental constraints, or lack of an effective suppression technique, tree loss by the mountain pine beetle epidemic must be accepted. Where beetle infestations occur in forested areas that are not included in the timber land base, such as noncommercial forest lands, national or state parks and wilderness areas, the do-nothing alternative is a viable management option.
6. Combination of all the Alternatives. All of the aforementioned alternatives could be used in varying combinations to best meet the management objectives for the area.

RECOMMENDATIONS

The mountain pine beetle infestation is predicted to continue to increase because average stand age and average stand diameter have reached the susceptible level in many areas. Based on elevation approximately 10,000 acres are in the high risk category. Hence, the following recommendations are made:

1. Identify, list and quantify management objectives and goals for this special project area.
2. If the MPB outbreak is threatening attainment of outputs, quickly identify and obtain stand and other pertinent information.
3. Develop a comprehensive action plan to mitigate the impacts of the MPB infestation and be responsive to attainment of the objectives and goals established for the area. Utilize Alternative 6, Combination of all the Alternatives, and request the services of Forest Pest Management for technical assistance and advice as needed.

LITERATURE CITED

- ALEXANDER, Robert R. 1975. Partial cutting in old-growth lodgepole pine. USDA For. Ser. Res. Paper RM-136, 17 p.
- AMMAN, Gene D., and Bruce H. Baker. 1972. Mountain pine beetle influence on lodgepole pine stand structure. J. For. 70(4):204-209.
- AMMAN, Gene D., Mark D. McGregor, Donn B. Cahill, and William H. Klein. 1977. Guidelines for reducing losses of lodgepole pine to the mountain pine beetle in unmanaged stands in the Rocky Mountains. USDA For. Ser. Gen. Tech. Rep. INT-36, 19 p.
- COLE, Walter E. 1965. The mountain pine beetle in lodgepole pine. Progress Report - Study I, Development of sampling procedures. USDA For. Ser., In-service report, 25 p.
- COLE, Walter E., and Gene D. Amman. 1980. Mountain pine beetle dynamics in lodgepole pine forests. Part I: Course of an infestation. USDA For. Ser. Gen. Tech. Rep. INT-89, 56 p.
- CLARY, Warren P. and Frederic R. Larson. 1971. Elk and deer use are related to food sources in Arizona ponderosa pine. USDA For. Ser. Res. Note RM-202, 4 p.
- MCCAMBRIDGE, William F., Gene D. Amman, and Galen C. Trostle. 1979. Mountain pine beetle. USDA For. Ser. Forest Insect & Disease Leaflet 2, 7 p.
- REGELIN, Wayne L. and Olaf C. Wallmo. 1978. Duration of deer forage benefits after clearcut logging of subalpine forests in Colorado. USDA For. Ser. Res. Note RM-356, 4 p.

POPULATION STAND TABLE
HOLY CROSS DIST WHITE R.
HOST SPECIES IS LODGEPOLE PINE

THE PEST IS MTN PINE BEETLE

THE METHOD OF SAMPLING WAS VARIABLE THE FIGURES IN THIS TABLE ARE BASED ON A SAMPLE OF 45 PLOTS, AND

REPRESENT AN AREA OF 5000 ACRES.

BAF WAS 10.

THIS TABLE ONLY INCLUDES HOST TREES

NUMBERS OF TREES

PER ACRE

DBH	LPP GRN	LPP CUR	LPP OLD	LPP PREV			TTL AK	PERCENT	TOTAL	PERCENTILE
5.0- 5.9	27.961	.000	.000	.000	.000	.000	.000	.000	27.961	12.413
6.0- 6.9	31.872	.000	.000	.000	.000	.000	.000	.000	31.872	14.149
7.0- 7.9	32.951	.000	.653	.000	.000	.000	.653	1.443	33.603	14.918
8.0- 8.9	33.838	.000	.000	.000	.000	.000	.000	.000	33.838	15.022
9.0- 9.9	24.412	.000	.919	.000	.000	.000	.919	3.627	25.331	11.245
10.0- 10.9	17.133	.000	.807	.000	.000	.000	.807	4.497	17.940	7.964
11.0- 11.9	18.980	.000	.000	.000	.000	.000	.000	.000	18.980	8.426
12.0- 12.9	11.141	.000	.501	.000	.000	.000	.501	4.306	11.642	5.168
13.0- 13.9	8.474	.000	.230	.000	.000	.000	.230	2.646	8.704	3.864
14.0- 14.9	5.290	.000	.000	.000	.000	.000	.000	.000	5.290	2.348
15.0- 15.9	3.926	.000	.179	.000	.000	.000	.179	4.353	4.105	1.822
16.0- 16.9	2.755	.000	.155	.000	.000	.000	.155	5.335	2.910	1.292
17.0- 17.9	1.581	.000	.000	.000	.000	.000	.000	.000	1.581	.702
18.0- 18.9	1.107	.000	.000	.000	.000	.000	.000	.000	1.107	.492
19.0- 19.9	.108	.000	.000	.000	.000	.000	.000	.000	.108	.048
20.0- 20.9	.283	.000	.000	.000	.000	.000	.000	.000	.283	.126
=====	=====	=====	=====	=====	=====	=====	=====	=====	=====	=====
TOTAL	221.81	.00	3.44	.00	.00	.00	3.44	1.53	225.26	100.00
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
PERCENT	98.47	.00	1.53	.00	.00	.00	1.53			
=====	=====	=====	=====	=====	=====	=====	=====	=====	=====	=====

AVERAGE DIAMETER FOR HOST TREES

LPP GRN	LPP CUR	LPP OLD	LPP PREV			TOTAL
10.9229	.0000	11.7000	.0000	.0000	.0000	10.9535

SURVEY SUMMARY

05 MAR 81

STATISTICAL ANALYSIS FOR HOST TREES

HOLY CROSS DIST WHITE R.

	AVE. NO. OF TREES PER ACRE	STANDARD DEVIATION	STANDARD ERROR	COEFFICIENT OF VARIATION	ESTIMATED NO. OF TREES	
					LOWER LIMIT	UPPER LIMIT
LPP GRN	221.81262	.15053273+03	.22440094+02	67.86482	.99686265+06	.12212636+07
LPP CUR	.00000	.00000000	.00000000	.00000	.00000000	.00000000
LPP OLD	3.44397	.18935383+02	.28227202+01	549.81258	.31062508+04	.31333452+05
LPP PREV	.00000	.00000000	.00000000	.00000	.00000000	.00000000
	.00000	.00000000	.00000000	.00000	.00000000	.00000000
	.00000	.00000000	.00000000	.00000	.00000000	.00000000
TOTAL	3.44397	.18935383+02	.28227202+01	549.81258	.31062508+04	.31333452+05

FOREST INSECT AND DISEASE

SURVEY SUMMARY
05 MAR 81A₃POPULATION STAND TABLE
HOLY CROSS DIST WHITE R.
HOST SPECIES IS LODGEPOLE PINE

THE PEST IS MTN PINE BEETLE

THE METHOD OF SAMPLING WAS VARIABLE

THE FIGURES IN THIS TABLE ARE BASED ON A SAMPLE OF 45 PLOTS, AND

REPRESENT AN AREA OF 5000 ACRES.

HAF WAS 10.

THIS TABLE ONLY INCLUDES HOST TREES

SQ. FT. OF BASAL AREA

PER ACRE

DBH	LPP GRN	LPP CUR	LPP OLD	LPP PREV	TTL AK	PERCENT	TOTAL	PERCENTILE
5.0- 5.9	4.444	.000	.000	.000	.000	.000	4.444	4.016
6.0- 6.9	7.333	.000	.000	.000	.000	.000	7.333	6.627
7.0- 7.9	10.000	.000	.222	.000	.222	2.174	10.222	9.237
8.0- 8.9	13.111	.000	.000	.000	.000	.000	13.111	11.847
9.0- 9.9	11.778	.000	.444	.000	.444	3.636	12.222	11.044
10.0- 10.9	10.222	.000	.444	.000	.444	4.167	10.667	9.639
11.0- 11.9	13.333	.000	.000	.000	.000	.000	13.333	12.048
12.0- 12.9	4.333	.000	.444	.000	.444	4.545	9.778	8.835
13.0- 13.9	8.222	.000	.222	.000	.222	2.632	8.444	7.631
14.0- 14.9	6.000	.000	.000	.000	.000	.000	6.000	5.422
15.0- 15.9	5.111	.000	.222	.000	.222	4.167	5.333	4.819
16.0- 16.9	4.000	.000	.222	.000	.222	5.263	4.222	3.815
17.0- 17.9	2.667	.000	.000	.000	.000	.000	2.667	2.410
18.0- 18.9	2.000	.000	.000	.000	.000	.000	2.000	1.807
19.0- 19.9	.222	.000	.000	.000	.000	.000	.222	.201
20.0- 20.9	.667	.000	.000	.000	.000	.000	.667	.602
TOTAL	108.44	.00	2.22	.00	.00	2.22	110.67	100.00
PERCENT	97.99	.00	2.01	.00	.00	2.01		

12

SURVEY SUMMARY
05 MAR 81A₄POPULATION STAND TABLE
HOLY CROSS DIST WHITE R.
HOST SPECIES IS LODGEPOLE PINE

THE PEST IS MTN PINE BEETLE

THE METHOD OF SAMPLING WAS VARIABLE

THE FIGURES IN THIS TABLE ARE BASED ON A SAMPLE OF

45 PLOTS, AND

REPRESENT AN AREA OF 5000 ACRES.

BAF WAS 10.

THIS TABLE ONLY INCLUDES NON-HOST TREES

NUMBERS OF TREES

PER ACRE

DBH	SPRUCE	ASPEN	TRUE FIR	OTHER	TOTAL	PERCENTILE
5.0- 5.9	.000	.000	1.170	.000	.000	1.170
6.0- 6.9	1.871	.000	1.060	.000	.000	2.931
7.0- 7.9	.000	.000	.832	.000	.000	.832
8.0- 8.9	.000	.000	.606	.000	.000	.606
9.0- 9.9	.451	.000	.000	.000	.000	.451
11.0- 11.9	.325	.000	.325	.000	.000	.650
12.0- 12.9	.257	.000	.000	.000	.000	.257
13.0- 13.9	.241	.000	.000	.000	.000	.241
14.0- 14.9	.000	.000	.189	.000	.000	.189
15.0- 15.9	.174	.000	.000	.000	.000	.174
17.0- 17.9	.133	.000	.000	.000	.000	.133
23.0- 23.9	.072	.000	.000	.000	.000	.072
TOTAL	3.52	.00	4.18	.00	.00	7.70
PERCENT	45.73	.00	54.27	.00	.00	.00

AVERAGE DIAMETER FOR NON-HOST TREES

SPRUCE	ASPEN	TRUE FIR	OTHER	TOTAL
12.9000	.0000	8.8667	.0000	.0000

13

FOREST INSECT AND DISEASE

A5

SURVEY SUMMARY
05 MAR 81

POPULATION STAND TABLE
HOLY CROSS DIST WHITE R.
HOST SPECIES IS LODGEPOLE PINE

THE PEST IS MTN PINE BEETLE

THE METHOD OF SAMPLING WAS VARIABLE

THE FIGURES IN THIS TABLE ARE BASED ON A SAMPLE OF 45 PLOTS, AND

REPRESENT AN AREA OF 5000 ACRES.

BAF WAS 10.

THIS TABLE ONLY INCLUDES NON-HOST TREES

S Q. FT. OF BASAL AREA

PER ACRE

DRH	SPRUCE	ASPEN	TRUE FIR	OTHER	TOTAL	PERCENTILE
5.0- 5.9	.000	.000	.222	.000	.222	6.667
6.0- 6.9	.444	.000	.222	.000	.667	20.000
7.0- 7.9	.000	.000	.222	.000	.222	6.667
8.0- 8.9	.000	.000	.222	.000	.222	6.667
9.0- 9.9	.222	.000	.000	.000	.222	6.667
11.0- 11.9	.222	.000	.222	.000	.444	13.333
12.0- 12.9	.222	.000	.000	.000	.222	6.667
13.0- 13.9	.222	.000	.000	.000	.222	6.667
14.0- 14.9	.000	.000	.222	.000	.222	6.667
15.0- 15.9	.222	.000	.000	.000	.222	6.667
17.0- 17.9	.222	.000	.000	.000	.222	6.667
23.0- 23.9	.222	.000	.000	.000	.222	6.667
TOTAL	2.00	.00	1.33	.00	3.33	100.00
PERCENT	60.00	.00	40.00	.00	.00	

14

U

APPENDIX B. Mountain Pine Beetle Risk Determination for 35 Lodgepole Pine Stands and Survey Data Representing the Remaining Lodgepole Pine Component of the Vail-Minturn-Beaver Creek, Special Project Area.

Compartment No. or Area	Stand No. Area	Mountain Pine Beetle Risk Factors*			Risk Index	Risk Category
		Average Age	Average d.b.h.	Elevation Latitude		
028-01	04	3	2	3	18	Moderate
	09	3	3	3	27	High
028-02	02	3	2	3	18	Moderate
	07	3	2	3	18	Moderate
060-02	09	2	3	3	18	Moderate
	01	1	2	1	2	Low
060-02	02	1	3	1	3	Low
	03	1	3	1	3	Low
	04	1	2	1	2	Low
	05	3	2	1	6	Low
	06	2	3	1	6	Low
	07	2	3	1	6	Low
	08	2	2	1	4	Low
	09	1	1	1	1	Low
	10	1	3	1	3	Low
	12	2	3	1	6	Low
	13	2	3	1	6	Low
060-03	02	1	2	3	6	Low
	06	3	2	3	18	Moderate
	07	3	3	3	27	High
	09	3	3	2	18	Moderate
	12	3	2	3	18	Moderate
	15	3	2	3	18	Moderate
	17	3	3	1	9	Low
	20	3	2	1	6	Low
060-04	21	3	3	1	9	Low
	02	2	1	3	6	Low
	23	1	1	2	2	Low
	24	2	1	2	4	Low
	25	1	1	2	2	Low
060-06	39	2	1	1	2	Low
	10	3	2	2	12	Moderate
	12	3	3	2	12	Moderate
	17	2	3	3	12	Moderate
	20	2	2	3	12	Moderate
	21	2	3	3	18	Moderate
Area Elsewhere	Below 9600'	3	3	3	27	High
	9600-10,500'	3	3	2	18	Moderate
	Above 10,500'	3	3	1	9	Low

*Risk Factors Used:

	Elevation-latitude	Average Age (Years)	Average d.b.h. (Inches)
High	(1)	<60 (1)	<7 (1)
Moderate	(2)	60-80 (2)	7-8 (2)
Low	(3)	>80 (3)	>8 (3)